



Significance of chest ultrasound in the early postoperative period following thoracic surgery

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In internal medicine, thoracic and lung ultrasound is used to diagnose pleural masses/fluid collections, for staging lung cancer, for excluding pneumothorax and pulmonary edema, and for diagnosing pulmonary embolisms (1,2). The value of lung ultrasound in emergency and intensive care medicine also has been estimated increasingly over the last years (3,4). Although there are well-known limitations caused by the air-containing lung, this method can successfully visualize solid nodules and lung consolidations that are just below the pleura as long as no pneumothorax is present. Chest ultrasound also has a high accuracy and is superior to the chest X-ray for the diagnosis of pleural effusion, pneumothorax, and lung consolidation (5).

In thoracic surgery, the timely detection of postoperative complications is difficult due to the absence or late presentation of clinical symptoms. The chest tube can be used for diagnosis, but may be insufficient due to obstructions from clotted blood. In postoperative cases with complications, chest X-ray frequently reveals a partial or complete opacification of the hemithorax such that it is not possible to distinguish between hemothorax, pleural effusion, obstructive atelectasis, and pneumonia. In contrast, sonography is capable of determining the cause of opacification; various causes of lung consolidation, including pneumonia, compression, and obstructive atelectasis, are easily distinguished by ultrasound (3,6).

We systematically use ultrasound intraoperatively during video-assisted thoracoscopy and thoracotomy (7). Intraoperative ultrasound provides important information

regarding tumor localization and tumor infiltration in adjacent structures, such as vessels. Furthermore, endothoracic sonography improves the estimation of operability in locally advanced lung cancer (8). Intraoperative ultrasound is therefore an important tool in determining the operative strategy, including the resection amount, thereby increasing the safety of the operation.

For incomprehensible reasons, however, chest ultrasound has not gained prominence as an important diagnostic tool following thoracic surgery; for example, only a few studies have evaluated the use of chest ultrasound for the postoperative management of chest tubes. One prior study reported that ultrasound has a 100% negative predictive value for pneumothorax, and therefore can predict the safe removal of chest tubes without the need for routine X-rays (9). Recently, we showed that video-assisted thoracoscopic surgery for atypical lung resection without a chest tube is safe. A prerequisite was the postoperative chest ultrasound. These findings therefore suggest that the diagnostic function of the chest tube during the postoperative period can be replaced by chest ultrasound.

For the first time, Chiappetta *et al.* (10) have evaluated the effectiveness of chest ultrasound after thoracic surgery compared to chest X-ray. They tested whether a postoperative chest ultrasound was sufficient, or if X-ray was additionally needed for a better evaluation. Chest X-rays were required in only 5 of their 24 cases; in the remaining 19 cases, chest ultrasound was considered sufficient and effective, and increased the diagnostic accuracy of

pneumothorax, pleural effusion, and lung consolidation. One of the major strengths of chest ultrasound in this study was the ability to discriminate between obstructive and post-hypoventilation atelectasis by analyzing the bronchogram during recruitment maneuvers. Chest ultrasound was considered sufficient, especially in minimal invasive thoracic surgery. The major limitation of postoperative ultrasound examination in this study was the inability to find a sound window in the case of massive subcutaneous emphysema.

Despite the utility of chest ultrasound, it is important to assess ultrasound findings within the clinical context, especially with respect to therapeutic need. For example, a small pneumothorax or pleural effusion, which is only detectable by ultrasound, has no clinical significance in the early postoperative period. It is important to be cautious, therefore, of overtreatment based on ultrasound findings. The main advantage of chest ultrasound in the postoperative period is the early diagnosis of relevant bleeding in cases of an insufficient chest tube. Chest ultrasound also has the advantage of discriminating between obstructive atelectasis requiring bronchoscopy and pleural effusion requiring a chest tube correction. As a final note of caution, despite improvements in diagnosis due to ultrasound, it remains important to also conduct physical examinations, including lung auscultations, during the postoperative period, as auscultation can provide the earliest evidence of atelectasis formation.

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Footnote

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